IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Koji Abe, et al.	Art Unit:	1795
Serial No:	10/521,797	Examiner:	CHUO, TONY SHENG HSIANG
Filed:	January 21, 2005		
For:	LITHIUM SECONDARY BATTERY		

Hon. Commissioner of Patents and Trademarks
Washington, D.C. 20231

DECLARATION PURSUANT TO RULE 132

I, Takaaki KUWATA, one of the above-named applicants, declare and state that:

1. I am familiar with the prosecution history of the subject application.

2. I now submit additional experimental data which were obtained in an experimental run performed under my supervision. The experimental run was carried out in the same manner as described in Example 1 set forth in the specification. Further, some experimental data set forth in the specification are placed in this Declaration for better understanding on the advantageous features of our claimed invention.

Details of the experimental run and data are given below.

Run 1 for comparison (for additional comparison)

[Preparation of non-aqueous electrolytic solution]

In a nonaqueous solvent of EC:DEC (=3:7, volume ratio) was dissolved 1M of $LiPF_6$ to give a nonaqueous electrolytic solution. To the nonaqueous electrolytic solution was further added 0.5 wt.% of cyclohexylbenzene.

[Manufacture of lithium secondary battery and measurement of its battery performances]

$LiCoO_2$ (positive electrode active material, 80 wt.%), acetylene black (electro-conductive material, 10 wt.%), and poly(vinylidene fluoride) (binder, 10 wt.%) were mixed. To the resulting mixture was added 1-methyl-2-pyrrolidone. Thus produced mixture was coated on aluminum foil, dried, pressed, and heated to give a positive electrode.

Artificial graphite (negative electrode active material, 90 wt.%) and poly(vinylidene fluoride) (binder, 10 wt.%) were mixed. To the resulting mixture was added 1-methyl-2-pyrrolidone. Thus produced mixture was coated on copper foil, dried, pressed, and heated to give a negative electrode.

The positive and negative electrodes, a microporous polypropylene film separator, and the above-mentioned non-aqueous electrolytic solution were employed to give a coin-type battery (diameter: 20 mm, thickness: 3.2 mm).

The coin-type battery was charged at room temperature (20°C) with a constant electric current (0.8 mA) to reach 4.2 V (terminal voltage) for 5 hours. Subsequently, the battery was discharged to give a constant electric current (0.8 mA) to give a terminal voltage of 2.7 V. The charging-discharging cycle procedure was repeated.

The initial charge-discharge capacity was almost the same as the capacity measured in a battery using an 1M $LiPF_6$ and EC/DEC (3/7, volume ratio) solvent mixture (containing no additive) [see Comparison Example 1 set forth in Specification].

After the 50 cycle charging-discharging procedure, the retention of discharge capacity was 82.9% of the initial discharge capacity (100%).

The above-obtained retention of discharge capacity is compared with the experimental data set forth in Table 1 of the specification.

Example	Electrode Posi. / Nega.	Additive (amount: wt.%)	Electrolytic solution	Initial capacity (r.v.)	50% cycle retention (%)
2	$LiCoO_2$ / Art.	1-fluoro-4-cyclohexylbenzene (5.0)	1M $LiPF_6$ EC/DEC =3/7	1.01	91.4
Com. 3	$LiCoO_2$ / Art.	cyclohexylbenzene (5.0)	1M $LiPF_6$ EC/DEC =3/7	0.99	83.1
3	$LiCoO_2$ / Art.	1-fluoro-4-cyclohexylbenzene (0.5)	1M $LiPF_6$ EC/DEC =3/7	1.01	90.5
Add. Com.	$LiCoO_2$ / Art.	cyclohexylbenzene (0.5)	1M $LiPF_6$ EC/DEC =3/7	1.0	82.9

Remarks: "Add. Com." is for the above-described Run 1 for comparison.

3. My conclusion is given below.

The battery cycle performance (that is, discharge capacity retention after repeated charging-discharging procedure) of a lithium secondary battery is well improved if a cyclohexylbenzene having a benzene ring on which a fluorine atom is attached is incorporated into a nonaqueous electrolyte solution of the battery, as compared with a case in that cyclohexylbenzene is incorporated into the same nonaqueous electrolyte solution.

4. The above-mentioned declarant declares further that

all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that any willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Takaaki Kuwata

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November 17, 2008